

UPDATE OF THE U.S. DEPARTMENT OF ENERGY'S DEACTIVATION AND DECOMMISSIONING MARKET

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ABSTRACT

During the course of nuclear weapons production, the U.S. Department of Energy (DOE) and its predecessor agencies constructed over 20,000 facilities. Many of these facilities are contaminated with radioactive materials, hazardous chemicals, asbestos, and lead (including lead paint) and have exceeded their design life of 30–40 years since their construction in the 1940s and 1950s. With the end of the cold war, many of these facilities no longer serve a mission for the DOE and have been identified as “surplus.” Since these aging surplus facilities no longer serve a mission, DOE is deactivating and decommissioning (D&D) these facilities to reduce monitoring and maintenance costs, to decrease the potential for release of radioactive and hazardous materials to the environment and local communities, and to decrease the risk of industrial safety accidents due to the continued deterioration of these facilities.

The D&D market for facilities in the DOE Office of Environmental Management (EM) is estimated at over \$14 billion dollars and is expected to increase as sites determine their required end states and cleanup criteria. The D&D market for facilities yet to be declared surplus and transferred to EM for final disposition is estimated at \$25 billion. Thus the total life-cycle cost to D&D all DOE facilities is estimated at \$39 billion. This report provides an update to the assessment of DOE’s market for D&D services presented in September 1999 at the American Nuclear Society Second Topical Meeting and Exhibition on Decommissioning, Decontamination and Reutilization in Knoxville, Tennessee.¹ This updated paper is based on data available as of June 27, 2000.

INTRODUCTION

The Office of Environmental Management (EM) is responsible for waste management operations,

assessment and cleanup of inactive sites, and deactivation and decommissioning (D&D) of surplus Department of Energy (DOE) facilities. EM also oversees the transition of contaminated facilities from various Departmental programs once they are determined to be surplus to their original mission and ensures their safe and cost-effective final disposition.

Facility deactivation includes activities undertaken to reduce physical risks and hazards at surplus facilities, to decrease costs associated with facility mortgage, and to make these facilities available for potential reuse or eventual decommissioning. This includes the planning for and activities associated with removal of surplus materials, chemicals, supplies, classified equipment and documents, and stabilization of radioactive contamination. It also includes recycling, minimization, treatment, storage, and disposal of all secondary wastes generated during deactivation.

Facility decommissioning includes activities associated with characterization, decontamination, demolition, and final disposition of the facility and the equipment contained within. This also includes developing required regulatory and project management documents, characterization and engineering work plans to establish cleanup criteria, characterization reports, decontamination and dismantlement, disposing of decommissioning waste, verifying project completion, and issuing completion reports.

D&D also includes surveillance and maintenance (S&M) which is intended to maintain safe and stable conditions for surplus facilities, prior to deactivation and through the completion of decommissioning.

As of 1996, approximately 5000 of the Department’s 20,000 facilities had been identified as surplus. Of these, about 3314 directly supported the nuclear weapons production program, whereas the remaining surplus facilities (approximately 1692) were associated

with non-weapons operations and research.² Figure 1 shows the 1996 distribution of the surplus weapons production facilities by process category.

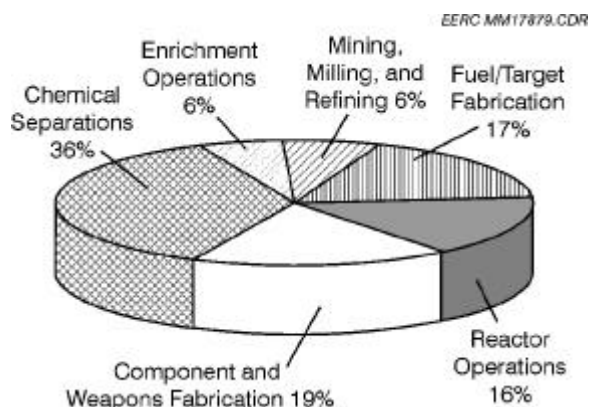


Fig. 1. DOE EM surplus facilities by process type.

Many of these facilities are massive concrete-reinforced structures often situated below grade. Though characterization is not yet complete, historical information and process knowledge suggests that a large portion of these surplus weapons production facilities and their associated equipment (e.g., process piping, ventilation ducts, and glove boxes) are contaminated or are suspected to be contaminated with hazardous, toxic, and/or radioactive substances.

Because of their physical characteristics and the chemical or radiological contaminants found within these facilities, numerous opportunities exist to develop and implement improved technologies and processes that can help DOE lower costs, accelerate schedules, and reduce the risks to workers, the public, and the environment associated with D&D operations. It is the intent of this paper to provide an overview of DOE's D&D market to assist perspective D&D contractors and technology developers in planning their activities such that these improvements can be realized by the Department.

THE DOE D&D MARKET

The analyses in the next section are based upon approved fiscal year (FY) 2000 data reported at both the Site Summary Level (SSL) and Project Baseline Summary (PBS) level within the Integrated Planning, Accountability, and Budgeting System – Information System (IPABS-IS).^a Site-reported SSL cost data are derived from project-level costs, though project-level D&D costs are not available within IPABS-IS.

Table 1 shows the DOE EM estimate of the D&D life-cycle costs for FY2000 through FY2070 in constant 2000 dollars (i.e., noninflation adjusted). As shown, \$4.25 billion of the D&D work is planned to occur between FY2000 and FY2006, and approximately 57% of the D&D activities will be performed after FY2006 at an estimated cost of \$5.68 billion. Figure 2 shows each DOE Operations Office's share of the DOE EM life-cycle cost for D&D. Combined, the Savannah River Site and Hanford Reservation account for 62% of the reported cost.

Table 1. SSL Life-Cycle Costs for DOE-EM D&D (\$ in thousands of constant FY2000 dollars)

	FY00–06	FY07–70	FY00–70
Deactivation	1,702,995	4,763,311	6,466,306
Decommissioning	2,546,515	913,521	3,460,036
Total	4,249,510	5,676,832	9,926,342

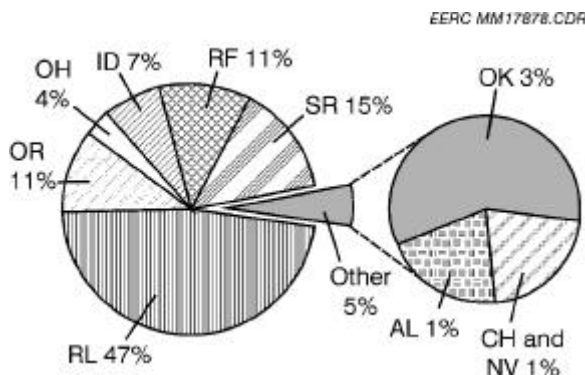


Fig. 2. Percentage of Life-Cycle (2000–2070) D&D Costs for EM Facilities, by DOE Operations Office (total equals \$9.93 billion).^b

In addition to surplus facilities for which EM has responsibility to disposition, an estimated 10,000 buildings are owned by DOE's Offices of Defense Programs, Nuclear Energy, and Science. The transfer of these facilities to EM was discontinued in 1996, but will resume in FY2002. Life-cycle costs to D&D these facilities are not reported in IPABS-IS; however, in the Department's *Accountability Report: Fiscal Year 1999*, the Office of the Chief Financial Officer estimated that the eventual stabilization, deactivation, and decommissioning of these contaminated facilities and structures will cost the Department \$25 billion.³ Thus the total DOE market for D&D services is in excess of \$35 billion. Analysis of IPABS-IS data in the next section will show this \$35 billion price tag to be a conservative estimate representing a lower bound for the overall DOE market for D&D services.

DATA AND UNCERTAINTIES

As previously mentioned, the D&D life-cycle cost of \$35 billion for DOE is a conservative estimate. Uncertainties with the EM life-cycle costs for D&D as reported in IPABS-IS suggest this value may as much as 10% higher. Table 2 provides more detail, at the DOE Operations Office level, of the SSL costs presented in Table 1.^c

Table 2. SSL Life-Cycle Costs for DOE-EM D&D, by Operations Office (in thousands of constant FY2000 dollars)

	Deact. (FY00-06)	Deact. (FY07-70)	Decom. (FY00-06)	Decom. (FY07-70)
Other	64,668	0	590,665	247,067
ID	68,798	124,157	81,659	465,716
OR	22,771	0	843,173	200,696
RF	73,028	0	1,031,018	42
RL	1,297,267	3,333,759	0	0
SR	176,463	1,305,395	0	0
Totals	1,702,995	4,763,311	2,546,515	913,521

The decline in decommissioning costs, as reflected in Table 2, for the FY2007 through FY2070 period as compared to the FY2000 through FY2006 period suggests that some sites have not accounted for the long-term disposition of their contaminated facilities. Most notable are Savannah River and Hanford. Analysis of the PBS narratives within IPABS-IS for Savannah River indicates that the site has not determined end states for its facilities and, as a consequence, has no costs allocated for final decommissioning and disposition. For Hanford, the PBS narratives suggest that projects have been baselined for facility decommissioning, but yet no decommissioning costs have been compiled at the site level.

Similarly, Oak Ridge Operations Office has reported no deactivation costs past FY2006, and their decommissioning costs after FY2006 appear low. This is noteworthy when considering the eventual D&D of the two currently operating gaseous diffusion plants (GDPs) under the authority of the Oak Ridge office – Portsmouth and Paducah. An analysis conducted in November 1997 estimated the cost for decommissioning, S&M, and reindustrialization of the Portsmouth and Paducah GDP's to be \$1.04 billion and \$1.01 billion, respectively.⁴ The United States Enrichment Corporation, a wholly owned government corporation established by the Energy Policy Act of 1992, is currently producing enriched uranium for commercial nuclear power plants at these two

facilities. DOE, however, maintains responsibility for the eventual D&D of these facilities, which will be financed by the Uranium Enrichment D&D Fund. The IPABS-IS life-cycle cost for the D&D Fund is currently estimated at \$5.0 billion.

Declining D&D costs after FY2006 for Rocky Flats are expected since it is a "Closure" site. Similarly, Operations offices under "Other" generally oversee "Closure" sites although D&D mission completion dates will extend beyond FY2006 for Los Alamos National Laboratory (FY2013), Nevada Test Site (FY2011), General Electric – Vallecitos (FY2009), and the Separations Process Research Unit (SPRU) (FY2015).

As noted earlier, since life-cycle cost by category (e.g., D&D) is not reported at the PBS level, it is not always possible to determine the actual D&D costs associated with the project. In order to assess the costs of specific D&D projects, a comparison was made between the total cost for PBS's with D&D (including facility S&M) scope and the D&D costs reported at the SSL (Table 3).^d This analysis was conducted for those sites with updated FY2000 ACPiC data in the IPABS-IS.

Comparison of the SSL D&D and total PBS cost data in Table 3 shows a strong correlation for some sites. This is true for INEEL, as well as the smaller sites Argonne-East; the West Jefferson Site in Columbus, Ohio; and the California General Electric site. Analysis of the PBS narratives indicates that these projects are essentially exclusively D&D in scope. The good correlation between the two data sets suggests that the D&D costs reported at the site level were derived from the baseline costs of the D&D and facility S&M projects (i.e., PBSs) listed.

The correlation between SSL D&D cost and PBS cost is not as strong for the remaining sites. This lack of correlation can, in most cases, be explained by projects that include both D&D and non-D&D scope. After excluding PBSs that include non-D&D activities (e.g. soil and groundwater remediation, waste treatment, disposition of special nuclear materials, and stabilization of special nuclear fuel), analysis reveals a similar strong correlation between the SSL D&D and PBS costs for several sites. For example, costs for PBSs shown in **bold** for Brookhaven, Fernald, and Oak Ridge represent 89.3%, 92.4%, and 98.6% of the SSL D&D cost, respectively. Presumably, the remaining D&D costs reported at the site level can be attributed to D&D scope included within those projects that also include non-DOE scope (i.e., the non-bolded PBSs).

Table 3. Comparison of SSL D&D Costs to Total PBS Cost, by Field Site
(in thousands of constant FY2000 dollars)

DOE Site	SSL D&D Total	PBS Total	PBS ID(s)
Grand Junction	5,430	110,201	AL024
Los Alamos	85,270	873,396	AL009 & AL030
Pantex	7,637	111,572	AL014
Argonne-E	22,701	22,481	CH-ANLEDD
Brookhaven	35,657	160,211	CH-BRNLDD & CH-BRNLRA
INEEL	740,330	753,136	ID-ER-110 & ID-OIM-110 to 113
Nevada Test Site	45,145	255,215	NV-214
Ashtabula	29,827	72,599	OH-AB-01
Columbus	72,875	74,826	OH-CL-01, OH-CL-02 & OH-CL-02-D
Fernald	158,641	526,503	OH-FN-02 & OH-FN-07
Mound	148,051	248,335	OH-MB-02, OH-MB-02-N & OH-MB-04 to OH-MB-07
West Valley	0	1,886,888	OH-WV-01LT & OH-WV-02LT
ETEC	69,288	79,003	OK-007 & OK-007LT

DOE Site	SSL D&D Total	PBS Total	PBS ID(s)
General Atomics	3,131	3,131	OK-012
General Electric	19,409	19,258	OK-013 & OK-013LT
LEHR	0	17,145	OK-010
SPRU	199,338	241,737	OK-043 & OK-043LT
Oak Ridge	986,093	2,079,108	OR-221, 231 , 241, 321, 331 , 341, 381, 423, 431 , 433 , 441 , 443 & 493
Paducah	80,547	951,214	OR-523 & OR-543
Portsmouth	0	50,191	OR-643
Rocky Flats ETS	1,104,088	1,809,526	RF001, RF014 to RF021
Hanford	4,631,026	7,433,345	RL-ER05, ER06, ST01, TP02, TP04, TP05, TP08, TP10, TP11, TP13, TP14, WM01 & WM02
Savannah River	1,481,858	5,344,189	SR-FA02, FA16 to FA20, FA23 to FA35 & SR-IN13

None of the projects listed for Grand Junction, Pantex, Los Alamos, Nevada, Ashtabula, and Rocky Flats are exclusively D&D in nature. For those sites where only one project has been identified with D&D scope included (e.g., Grand Junction, Pantex, Ashtabula and Nevada), it is assumed that the life-cycle costs for facility D&D represented in the PBS must be equal to the reported SSL D&D life-cycle cost. For Los Alamos and Rocky Flats, however, multiple projects contain D&D scope in addition to non-D&D scope. For these sites, it is also assumed that the SSL D&D costs accurately reflect the total life-cycle cost to D&D all the facilities represented in the PBSs. Because of the IPABS-IS data-reporting limitations discussed, it is

not possible to determine the allocation of site-level D&D costs to the project level at these two sites.

The PBSs listed for Hanford vary in their degree of D&D scope from those that contain predominantly D&D scope to those that contain only minor D&D scope and are predominantly non-D&D in nature. As mentioned previously, Hanford has only reported facility deactivation and no decommissioning costs at the site level for FY2000 through FY2070 (see Table 2). This in itself is noteworthy given the degree to which the project baseline narratives describe decommissioning activities at the site. This anomaly suggests that either the costs reported by Hanford for facility deactivation also include decommissioning

costs or that the market for decommissioning Hanford's facilities have not been baselined and included in the SSL data. If the latter is true, then the overall D&D market for Hanford has been underestimated. The data in IPABS-IS cannot be used to confirm or deny that the market has been underestimated; thus, lacking better data, this analysis assumes that the life-cycle costs reported at the site level for Hanford's facility deactivation represent the entire D&D market for the site.

Conversely, the PBSs listed for Mound and Savannah River are almost exclusively D&D in scope, yet the reported SSL D&D cost is significantly lower than the PBS's total life-cycle cost. For Mound, the higher PBS life-cycle cost of approximately \$100 million may represent additional D&D market. Further analysis of IPABS-IS data suggests that the D&D market at Savannah River may be better represented by the total life-cycle cost associated with the projects listed in Table 3 rather than by the D&D costs reported at the site level (i.e., \$5.3 versus \$1.5 billion). Table 4 shows the life-cycle costs for two cost categories—facility deactivation and long-term surveillance and maintenance (LT S&M)—reported at the site level for Savannah River in FY2000.

Table 4. Comparison of SSL D&D Costs to Total PBS Cost for Savannah River (in thousands of constant FY2000 dollars)

Cost Category	SSL Total	PBS Total	PBS ID(s)
Facility Deactivation	1,481,858	5,344,189	SR-FA02, FA16 to FA20; FA23 to FA35 & SR-IN13
LT S&M	5,618,954	1,730,698	SR-ER01, ER02, ER03, ER04, ER05 & ER06

Table 4 shows the poor correlation between site-level and project-level costs for each cost category. The difference between site- and project-level costs is \$3.9 billion for both facility deactivation and LT S&M. Analysis suggests that the poor correlation can be attributed almost entirely to one PBS: SR-FA26 "Long Term Stewardship." The life-cycle cost associated with this PBS for the period FY2000 through FY2070 is \$4.0 billion. In Table 4 (and Table 3) the cost for this project has been included in the \$5.3 billion PBS total for Savannah River because the PBS narrative clearly describes activities associated with surveillance, maintenance, and monitoring of facilities prior to end state determination and final facility disposition. This is consistent with the observed lack of

decommissioning costs reported by Savannah River for the period FY2000 through FY2070. The life-cycle cost associated with SR-FA26 appears to have been included though within the SSL cost category LT S&M. Thus this analysis assumes that the \$4 billion associated with this one PBS has been incorrectly allocated to the site-level cost category LT S&M and represents an additional market for D&D.

This assumption is strengthened by comparing the D&D site-level life-cycle costs reported in the FY1999 *ACPtC* to the FY2000 data in IPABS-IS. In FY1999, Savannah River reported \$6.3 billion for facility deactivation compared to \$1.5 billion in FY2000. The drop of \$4.8 billion for facility deactivation is offset by a corresponding increase of \$5.6 billion for LT S&M at Savannah River, of which \$4.0 billion is presumably contributed to "Long Term Stewardship," PBS SR-FA26.

The previous discussion has not been intended as a critical analysis of the *ACPtC* or the data reported in IPABS-IS, but rather to highlight potential data inconsistencies that may lead to an underestimation of the DOE market for D&D services. In summary, the SSL reported DOE EM market for D&D services may only be a "lower-bound" estimate for the following reasons:

- Costs associated with D&D scope that may not have been reported in the proper cost category at the site level (e.g., Savannah River). Additional D&D market of \$4 billion has been identified.
- Projects exist with clearly defined D&D scope, but the aggregate costs of these projects for a given site exceed the D&D costs reported at the site level (e.g., Mound). Additional D&D market of approximately \$100 million has been identified.
- Projects for which no D&D scope and baseline cost has yet been determined (e.g., the GDPs at Portsmouth and Paducah, the Waste Encapsulation and Storage Facility [WESF] at Hanford, Savannah River facility decommissioning and other facilities not yet transferred to EM). No additional D&D market has been assumed in this analysis for these projects.
- Projects exist with clearly defined D&D scope, but have no corresponding facility deactivation and/or decommissioning costs reported in the site level data (e.g., River Protection Program, Hanford, West Valley, Portsmouth, and the Laboratory for Energy-

Related Health Research [LEHR]). No additional D&D market has been assumed in this analysis for these projects.

Thus based on the analysis in the Data and Uncertainties section, it appears that the DOE EM D&D market has been underestimated by at least \$4 billion. Adding this to the reported \$10 billion DOE EM D&D market and the estimated \$25 billion D&D market for facilities yet to be transferred to EM, the total D&D market for the Department is conservatively estimated at \$39 billion.

DOE SITE AND FACILITY SUMMARIES

The following is a brief description of substantial D&D challenges facing DOE at its major sites in future years. This information was collected and summarized from the PBSs, which vary greatly in their level of detail. This discussion is not intended to be all inclusive. More information can be found on the *ACPtC* documents which can be accessed through the DOE EM homepage <http://www.doe.em.gov>.

Albuquerque Operations Office

The Albuquerque Operations Office currently has D&D operations at LANL, Pantex Plant, and Grand Junction. LANL has about 100 structures requiring decommissioning, including a plutonium-processing facility, a tritium facility, and the Omega West Reactor facility. Pantex presently has a single facility (Building 12–24) scheduled for D&D. Planned decommissioning work at Grand Junction includes demolition or decontamination for reuse of about 11 buildings by FY2001.

Chicago Operations Office

The Chicago Operations Office is responsible for D&D activities at Argonne National Laboratory-East, Brookhaven National Laboratory (BNL), and Princeton Plasma Physics Laboratory (PPPL). Decommissioning work at Argonne-East should be completed by FY2003 and includes the Zero Power Reactor and Juggernaut Reactor facilities, Building 310 Retention Tank, 60-inch Cyclotron, and Building 301 Hot Cell facility. Decommissioning work is scheduled to be completed in FY2006 on the BNL Graphite Research Reactor and structures associated with the Hazardous Waste Management Facility. The Tokamak Fusion Test Reactor (TFTR) at PPPL will be fully decommissioned by the end of FY2002.

Idaho Operations Office

Since 1949, INEEL constructed and operated 53 test or experimental reactors. INEEL also constructed and operated a complex consisting of spent nuclear fuel reprocessing, fuel storage, tank farm, and calcining facilities.

The main areas at INEEL that will undergo D&D are the Test Reactor Area (TRA), Test Area North (TAN), Idaho Chemical Processing Plant (ICPP), Central Facilities Area (CFA), Power Burst Facilities (PBF), and the Radioactive Waste Management Complex. Among these process areas, there are 215 contaminated surplus facilities and structures that pose a long-term risk to site workers and the environment, resulting in substantial S&M cost. Current D&D projects at INEEL are focused on reducing these risks and accelerating cleanup such that the large S&M mortgage can be reduced.

Facility projects at INEEL are divided into S&M, deactivation, and decontamination and decommissioning. S&M activities before FY2007 focus on portions of the ICPP that contain fissile material and numerous process cells, the PBF reactor, and the 120,000-gallon Materials Test Reactor (MTR) canal containing spent fuel elements.

Deactivation projects to be completed by the end of FY2006 include the reactor buildings at PBF and the MTR Fuel Storage Canal. Deactivation projects to be initiated after FY2000 include work at fuel reprocessing facilities, fuel storage facilities, low-level liquid waste processing, offgas systems, and high-level waste (HLW) storage and treatment facilities at the ICPP, TAN, and TRA. Decontamination and decommissioning projects to be completed by the end of FY2006 include nearly 31 ancillary facilities at the TAN, TRA, CFA, and PBF areas.

Oakland Operations Office

Facilities managed by the Oakland Operations Office that will undergo D&D include the Energy Technology Engineering Center (ETEC); LEHR; a glove box and hot cell at General Electric in Vallecitos, California; and SPRU.

ETEC's surplus facilities at the Santa Susana Field Laboratory include the Sodium Disposal Facility, the Nuclear Development Test Facility, and the Radioactive Materials Handling Facility. D&D of the lone LEHR facility, the GER I waste staging/storage

area, will be completed in FY2003. The D&D activities for the Emission Spectrograph glove box and the Alpha Hot Cell 4 at the General Electric site will be completed in FY2003 and 2008, respectively. SPRU pilot plant facilities for the development of the REDOX and PUREX processes will be decontaminated and demolished for release and unrestricted site use by 2014.

Oak Ridge Operations Office

This office has responsibility for D&D operations at the Oak Ridge Reservation (ORR) and the Paducah and Portsmouth GDPs.

The ORR D&D efforts are divided into three main projects: Oak Ridge National Laboratory (ORNL), Y-12, and the East Tennessee Technology Park (ETTP).

The ORNL project includes D&D of research reactors, tanks, auxiliary buildings and equipment, isotopes processing buildings, surface facilities and wells associated with hydrofracture operations, and other radioactively contaminated structures.

The Y-12 project will accomplish the D&D of the Alpha IV (Building 9201-4) Lithium Colex Process. This facility is a 600,000-square foot transite covered structural steel and concrete facility. The process equipment will be removed, and the facility decontaminated and converted to warehouse status for future use.

The ETTP D&D effort consists of three primary projects. The first project, the Centrifuge Equipment Removal consists of three categories of work, including 1) facility radiological characterization and subsequent decontamination activities, 2) strip-out of components inside buildings (e.g., removal of gas centrifuges from K-1600, K-1210, and K-1220), and 3) demolition of auxiliary support facilities. Facilities not demolished will be available for reuse under the Reindustrialization program.

The second ETTP project focuses primarily on decontamination and demolition of radiologically contaminated facilities, principally the K-25/K-27 buildings. These two buildings represented the High Enriched Uranium end of the enrichment process. Specific efforts will include facility utility deactivation, strip-out of process/nonprocess equipment and piping, decontamination/demolition, and waste disposal.

The third ETTP project focuses on D&D of buildings (K-29/K-31/K-33) and equipment of the Low Enriched Uranium end of the process. The GDP buildings will be decontaminated for free release and reuse under the Reindustrialization program.

Enrichment operations at Portsmouth will cease permanently in June 2001, with its return to DOE occurring in June 2002. Enrichment operations, however, will continue at Paducah although D&D of the now redundant C-340 and C-410 complexes will be completed in FY2007.

Ohio Operations Office

The Ohio Operations Office is responsible for D&D at Ashtabula, Ohio; Battelle-Columbus West Jefferson site; West Valley; Mound; and Fernald. Remediation of the Ashtabula depleted uranium extrusion facility involves deactivation of 22 buildings and associated equipment, followed by decontamination of four, and demolition of the remaining buildings. Battelle's West Jefferson site includes large hot cells in Building JN-1; Building JN-2 which is a two-story office and laboratory building with a high bay; and Building JN-3 which houses a "pool" type reactor.

The Mound Plant supported the tritium program for over 45 years. Decommissioning of the primary buildings (Semi-Works [SW], Research [R], and Technical [T]) will involve over 1000 linear feet of tritiated glove boxes, tritiated pump oil and mercury, miles of process piping and ductwork, uranium beds, molecular sieves, and other equipment. In addition, Building 58, H-Building, B-stack, C-Building, and E and E Annex will be demolished or decontaminated for industrial reuse. The SM/PP Hill project involves decommissioning of 12 structures including a plutonium processing facility. The Test Fire Valley project will D&D 34 facilities, transitioning some for possible reuse.

Fernald receives closure funds and plans to complete environmental restoration at its site by FY2006. Fernald received raw uranium ore and processed the ore for subsequent use within the DOE weapons complex. The D&D project will disposition all facilities by the completion of FY2006 except the Advanced Waste Water Treatment Complex, South Plume Interim Treatment Facility, and the Silos.

West Valley D&D activities include final disposition of the HLW facilities—process building, vitrification facility, tank farm, and remote handling waste

facility—by FY2015 and disposition of the HLW canister interim storage building in FY2041.

Nevada Operations Office

D&D at the Nevada Test Site will include the Test Cell A and C facilities, the Reactor Maintenance Assembly and Disassembly facility, and the Super Kukla Reactor building. D&D activities will be completed in FY2010.

Richland Operations Office

Major deactivation projects at the Hanford Reservation include 300 Area Fuel Supply Shutdown Complex, Plutonium Finishing Plant (PFP) Deactivation Project, 324/327 Facility Transition Project, Accelerated Deactivation, Advanced Reactors Transition, and 300 Area Revitalization Project.

The 300 Area Fuel Supply Shutdown Complex produced fuel for the Hanford Single Pass Reactor and the N-Reactor. This complex consists of several buildings and contains 1800 metric tons of unirradiated low-enriched fuel.

The PFP processed plutonium-bearing solutions and converted them into plutonium oxide and metal. It also reclaimed plutonium from scrap metals. The PFP stores the nation's second largest plutonium inventory. The PFP Project will deactivate almost 60 buildings/structures.

324/327 Facility Transition Project includes the Waste Technology Engineering Laboratory (324) and the Post-Irradiation Test Laboratory (327). The 324 facility has controlled areas with potential dose rates in excess of 10 R per hour. The 327 facility houses eleven high-density metal-shielded hot cells, two unlined concrete water basins, and a dry storage cell. The 327 facility was used for inspection and analysis of fuel elements and materials, primarily from plutonium production reactors at Hanford.

The Advanced Reactors Transition project includes D&D of the Plutonium Recycle Test Reactor and Nuclear Energy Legacy Sodium Facilities, including those associated with the Liquid Metal Fast Breeder Reactor.

Hanford also has eight plutonium production reactors remaining in the 100 Area and five fuel reprocessing canyons in the 200 Area that will be the primary focus of the decontamination and decommissioning project. The reactor facilities will most likely be placed in an

interim safe storage condition similar to the 105-C Reactor. Hanford recently completed deactivation of the B-Plant and is currently evaluating alternative final disposition options for the canyon facilities. A decision is anticipated within a year or two. Also included is decommissioning of the Fast Flux Test Facility and the Fuels and Materials Examination Facility.

Hanford has many facilities which still serve a mission that will eventually require D&D. The WESF, for example, stores 2000 strontium and cesium capsules that contain 150 million curies of radioactive material, making it the largest concentration of radioactive material in the United States. Present plans call for the disposal of the capsules as high-level waste beginning around 2013 and continuing until 2017. Deactivation will begin after the capsules are removed.

Rocky Flats Operations Office

The Rocky Flats Plant fabricated and processed plutonium metal. Nearly 1000 glove boxes and miles of process pipe and ventilation ducts are contaminated with highly fissile material. The Rocky Flats Environmental Technology Site (RFETS) receives closure funds to complete decommissioning of its facilities by FY2007. Facility decommissioning projects at RFETS are divided in "clusters." The major D&D Cluster Closure Projects are Building 371, Building 771/774, Building 707/750, and Building 776/777.

The Building 371 Cluster Closure Project includes buildings used to recover plutonium and convert it to high-purity metal buttons, as well as recover americium and convert it to americium dioxide. The effort will require remediation of 300 metric tons of stored waste; 40,000 metric tons of structural materials; 6900 metric tons of equipment; and 58,000 gallons of chemicals.

The Building 771/774 Cluster Closure Project involves decommissioning of all tanks and piping systems in these facilities, including removal of liquids, sludge, and Raschig rings.

The Building 707/750 Cluster Closure Project involves decommissioning of several buildings. Building 707 is a 197,000-square foot building on two floors. Special Nuclear Materials were left in the building without any packaging.

The Building 776/777 Cluster Closure Project involves decommissioning of facilities associated with

manufacturing and assembly of nuclear weapons, waste operations including size reduction and incineration, and recovery of plutonium. These facilities contain plutonium-contaminated lubricants, shavings, and residues. The two buildings cover 230,820 square feet on two floors. There are about 120 metric tons of stored waste, 30,000 metric tons of structural members, 4000 metric tons of equipment, and 13,000 gallons of chemicals in these buildings.

Savannah River Operations Office

Most of the D&D work at Savannah River is scheduled after FY2006. Deactivation projects to be completed after FY2006 include the HLW facilities (e.g., Defense Waste Processing Facility); the Receiving Basin for Offsite Fuels facility; the D-Area heavy water facilities; the M-Area fuel fabrication facilities; the P-, C-, R-, K-, and L-Reactors; the F-Area Material Storage Facility; and the F- and H-Area chemical processing (canyon) facilities. The F and H canyon buildings are massive structures made of reinforced concrete, each measuring about 850 feet long and 125 feet wide.

Savannah River has a significant postdeactivation S&M program (PBS SR-FA26 Long-Term Stewardship). Presently, Savannah River has not determined end states for its facilities and as a consequence has not developed decommissioning projects.

Office of River Protection (Hanford Site)

Major projects will include D&D of Phase I and II low activity waste (LAW) and HLW vitrification facilities, the immobilized HLW storage facility, and the HLW tank above-ground facilities.

- c. Operations Offices represented by other include Albuquerque, Chicago, Nevada, Ohio, and Oakland.
- d. Table 3 reflects the same data as in Tables 1 and 2, but it is broken down to the Field Office level.

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4. J. A. CLINARD, D.W. MINTURN, L.D. CHARLES, G.A. PERSON, H.R. SHEELY, "D&D Estimate of Gaseous Diffusion Facilities Incorporating Site Reindustrialization," ES/ER/TM-235, January 1998.

FOOTNOTES

- a. The IPABS-IS, a key data collection and reporting component of the EM Corporate Database, is used to meet numerous national EM requirements including the FY 2000 *Accelerating Cleanup: Paths to Closure (ACPtC)* Report.
- b. Operations Office abbreviations: AL (Albuquerque); CH (Chicago); ID (Idaho); OH (Ohio); OK (Oakland); OR (Oak Ridge); NV (Nevada); RF (Rocky Flats); RL (Richland [includes Hanford site]); SR (Savannah River).